

Appl. No. 10/605,197
Amdt. dated December 8, 2004
Reply to Office action of September 08, 2004

AMENDMENTS TO THE CLAIMS

1. (currently amended) A regulated charge pump comprising:
 - 5 a negative charge pump for generating a first output voltage by determining an oscillation signal; [[and]]
 - a regulator for restricting a swing of the first output voltage, the regulator comprising:
 - 10 a level shift circuit connected to the negative charge pump for generating a second output voltage at an output end of the level shift circuit by determining the first output voltage generated by the negative charge pump, the level shift circuit comprising:
 - 15 a plurality of serially connected PMOS transistors,
 - a first source of a first PMOS transistor of the PMOS transistors connected to a first reference voltage source, a first gate and a first drain of the first PMOS transistor connected to the output end of the level shift circuit, and a second gate and a second drain of a second PMOS transistor of the PMOS transistors connected to the output end of the negative charge pump;
 - 20 a differential amplifier, whose first and second input ends are connected to a second reference voltage source and the output end of the level shift circuit respectively, for generating a compare signal by determining a voltage difference between the second output voltage and a voltage generated by the second voltage source;
 - 25 and
 - 30

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

5

a voltage-controlled oscillator connected between
an output end of the differential amplifier and
an input end of the negative charge pump[.];
and

10

a protection circuit, whose input end and output end are
connected to the output end of the negative charge pump
and wells of the PMOS transistors respectively, for
generating a first protection voltage at the output end
of the protection circuit by determining the first output
voltage.

15

2. (original) The regulated charge pump of claim 1, wherein the
second voltage source is ground.

3. (cancelled)

20
25

4. (currently amended) The regulated charge pump of claim 3 claim
1, wherein the protection circuit comprises:
a switch, whose first and second ends are connected to the
output end of the protection circuit and the first
protection voltage respectively; and
a voltage detection circuit connected to the switch and to
the output end of the negative charge pump for
controlling the switch by determining the first output
voltage.

30

5. (original) The regulated charge pump of claim 4, wherein when
the voltage detection circuit detects that the first output

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

voltage is lower than a threshold voltage, the switch is closed and transmits the first protection voltage to the wells of the PMOS transistors.

5

6-9. (cancelled)

10. (currently amended) A regulated charge pumping pump comprising:
10 a negative positive charge pump for generating a first output voltage by determining an oscillation signal; [[and]] a regulator for restricting a swing of the first output voltage, the regulator comprising:
15 a level shift circuit connected to the negative positive charge pump for generating a second output voltage at an output end of the level shift circuit by determining the first output voltage generated by the negative positive charge pump, the level shift circuit comprising:
20 a plurality of serially connected NMOS transistors, a first source of a first NMOS transistor of the NMOS transistors connected to a first reference voltage source, a first gate and a first drain of the first NMOS transistor connected to the output end of the level shift circuit, and a second gate and a second drain of a second NMOS transistor of the NMOS transistors connected to the output end of the negative positive charge pump;
25
30 a differential amplifier, whose first and second

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

5

input ends are connected to a second reference voltage source and the output end of the level shift circuit respectively, for generating a compare signal by determining a voltage difference between the second output voltage and a voltage generated by the second voltage source; and

10

a voltage-controlled oscillator connected between an output end of the differential amplifier and an input end of the negative positive charge pump[. . .] ; and

15

a protection circuit, whose input end and output end are connected to the output end of the positive charge pump and wells of the NMOS transistors respectively, for generating a first protection voltage at the output end of the protection circuit by determining the first output voltage.

20

11. (original) The regulated charge pump of claim 10, wherein the second voltage source is ground.

12. (cancelled)

25

13. (currently amended) The regulated charge pump of claim 12 claim 10, wherein the protection circuit comprises: a switch, whose first and second ends are connected to the output end of the protection circuit and the first protection voltage respectively; and

30

Appl. No. 10/605,197
Amndt. dated December 8, 2004
Reply to Office action of September 08, 2004

5 a voltage detection circuit connected to the switch and to the output end of the negative positive charge pump for controlling the switch by determining the first output voltage.

10 14. (original) The regulated charge pump of claim 13, wherein when the voltage detection circuit detects that the first output voltage is higher than a threshold voltage, the switch is closed and transmits the first protection voltage to the wells of the NMOS transistors.

15-18. (cancelled)

15 19. (new) A regulated charge pump comprising:
a negative charge pump for generating a first output voltage by determining an oscillation signal;
a regulator for restricting a swing of the first output voltage, the regulator comprising:
20 a level shift circuit connected to the negative charge pump for generating a second output voltage at an output end of the level shift circuit by determining the first output voltage generated by the negative charge pump, the level shift circuit comprising:
25 a plurality of serially connected PMOS transistors, a first source of a first PMOS transistor of the PMOS transistors connected to a first reference voltage source, a first gate and a first drain of the first PMOS transistor connected to the output end of the level shift circuit, and a

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

second gate and a second drain of a second PMOS transistor of the PMOS transistors connected to the output end of the negative charge pump;

5 a differential amplifier, whose first and second input ends are connected to a second reference voltage source and the output end of the level shift circuit respectively, for generating a compare signal by determining a voltage

10 difference between the second output voltage and a voltage generated by the second voltage source; and

15 a voltage-controlled oscillator connected between an output end of the differential amplifier and an input end of the negative charge pump; and

20 a protection circuit, whose input end, first, and second output ends are connected to the output end of the negative charge pump, a first well of the first PMOS transistor, and wells of remaining PMOS transistors respectively, for generating first and second protection voltages at first and second output ends of the protection circuit respectively by determining the first output voltage.

25 20. (new) The regulated charge pump of claim 19, wherein the second voltage source is ground.

30 21. (new) The regulated charge pump of claim 19, wherein the first protection voltage is higher than the second protection voltage.

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

22. (new) The regulated charge pump of claim 19, wherein the protection circuit comprises:
5 a switch, whose first, second, third, and fourth ends are connected to a first output end of the protection circuit, the first protection voltage, a second output end of the protection circuit, and the second protection voltage respectively; and
10 a voltage detection circuit connected to the switch and to the output end of the negative charge pump for controlling the switch by determining the first output voltage.

23. (new) The regulated charge pump of claim 22, wherein when 15 the voltage detection circuit detects that the first output voltage is lower than a threshold voltage, the switch is closed and transmits the first and second protection voltages to the first well of the first PMOS transistor and the wells of the remaining PMOS transistors respectively.

20 24. (new) A regulated charge pump comprising:
a positive charge pump for generating a first output voltage by determining an oscillation signal;
a regulator for restricting a swing of the first output 25 voltage, the regulator comprising:
a level shift circuit connected to the positive charge pump for generating a second output voltage at an output end of the level shift circuit by determining the first output voltage generated by the positive 30 charge pump, the level shift circuit comprising:

Appl. No. 10/605,197
Amdt. dated December 8, 2004
Reply to Office action of September 08, 2004

5 a plurality of serially connected NMOS transistors,
10 a first source of a first NMOS transistor of the
15 NMOS transistors connected to a first reference
20 voltage source, a first gate and a first drain
25 of the first NMOS transistor connected to the
output end of the level shift circuit, and a
second gate and a second drain of a second NMOS
transistor of the NMOS transistors connected to
the output end of the positive charge pump;
a differential amplifier, whose first and second
input ends are connected to a second reference
voltage source and the output end of the level
shift circuit respectively, for generating a
compare signal by determining a voltage
difference between the second output voltage and
a voltage generated by the second voltage source;
and
a voltage-controlled oscillator connected between
an output end of the differential amplifier and
an input end of the positive charge pump; and
a protection circuit, whose input end, first, and second
output ends are connected to the output end of the
positive charge pump, a first well of the first NMOS,
and wells of remaining NMOS transistors respectively,
for generating first and second protection voltages at
first and second output ends of the protection circuit
respectively by determining the first output voltage.

30 25. (new) The regulated charge pump of claim 24, wherein the

Appl. No. 10/605,197
Amtd. dated December 8, 2004
Reply to Office action of September 08, 2004

second voltage source is ground.

26. (new) The regulated charge pump of claim 24, wherein the first
5 protection voltage is lower than the second protection
voltage.

27. (new) The regulated charge pump of claim 24, wherein the
protection circuit comprises:
10 a switch, whose first, second, third, and fourth ends are
connected to a first output end of the protection circuit,
the first protection voltage, a second output end of the
protection circuit, and the second protection voltage
respectively; and
15 a voltage detection circuit connected to the switch and to
the output end of the positive charge pump for
controlling the switch by determining the first output
voltage.

20 28. (new) The regulated charge pump of claim 27, wherein when
the voltage detection circuit detects that the first output
voltage is higher than a threshold voltage, the switch is
closed and transmits the first and second protection voltages
25 to the first well of the first NMOS transistor and the wells
of the remaining NMOS transistors respectively.